

WHAT IS CLAIMED IS:

1 1. A database area network (DAN) system comprising:
2 a plurality of database management systems adapted for providing access to database
3 data;
4 a shared storage system, connected to said database management systems for storing said
5 database data;
6 a database switching system adapted for directing the transfer of data packets between at
7 least one database client and said database management systems.

1 2. The system of claim 1, wherein said database switching system includes a switching
2 device adapted for switching or routing said data packets between said at least one database
3 client and said database management systems.

1 3. The system of claim 1, wherein said database switching system is adapted for translating
2 a network destination address of a database service request received from a database client to a
3 network destination address of a database management system.

1 4. The system of claim 3, wherein said translated network destination address of a database
2 service is a network layer addresses or data link layer addresses.

1 5. The system of claim 3, wherein said network destination address of a database service is
2 translated from a virtual network address to an actual network destination address.

1 6. The system of claim 1, wherein said database switching system includes a routing or
2 switching device adapted to provide data packet routing or switching functions and said routing
3 or switching functions can be controlled using a command line interface procedure or a network
4 management protocol.

1 7. The system of claim 1, wherein said database switching system includes a redirection
2 module adapted for relocating a database instance from a first database server to a second
3 database server.

1 8. The system of claim 1, wherein said database switching system includes a resource
2 management module adapted for managing an association between database instances and
3 database servers.

1 9. The system of claim 8, wherein said resource management module further includes a data
2 storage device and is adapted for storing server resource information or database instance
3 requirements in said data storage device.

1 10. The system of claim 9, wherein said resource management module is further adapted for
2 managing the association between database instances and database servers as a function of the
3 server resource information or the database instance requirements.

1 11. The system of claim 9, wherein said resource management module is adapted for storing
2 constraints or preferences regarding database instance redirection in said data storage device.

1 12 The system of claim 11, wherein said resource management module is further adapted
2 for managing the association between database instances and database servers as a function of
3 said constraints or preferences regarding database instance redirection stored in said data storage
4 device.

1 13. The system of claim 1, wherein said database switching system further includes a module
2 adapted for relocating a database instance from a first database server to a second database server
3 as a function of defined database performance criteria.

1 14. The system of claim 1, wherein said database switching system includes a database
2 switching module adapted for associating database services with network addresses.

1 15. The system of claim 14, wherein said network addresses are virtual network addresses.

1 16. The system of claim 14, wherein said network addresses are network layer addresses or
2 data link layer addresses.

1 17. The system of claim 14 wherein said database switching system is adapted for directing
2 the transfer of data packets between said database clients and said database management systems
3 as a function of the associations between said database services and said network addresses.

1 18. The system of claim 14, wherein said database switching system is adapted for directing
2 the transfer of data packets between said database clients and said database management systems
3 by replacing a network address of said data packet containing a service request with the network
4 address associated with that service.

1 19. The system of claim 18, wherein the network address of said data packet containing a
2 service request is a virtual network address and said virtual network address is replaced with a
3 real network address associated with said service.

1 20. The system of claim 18, wherein the network address of said data packet containing a
2 service request is for a network address on a first subnetwork and said network address is
3 replaced with a network address associated with said database service on a second subnetwork.

1 21. The system of claim 14, wherein said database switching system includes a content
2 switch adapted to read at least a portion of the contents of packets transferred between said at
3 least on database client and said database management systems.

1 22. The system of claim 14, wherein said database switching system includes
2 a network device adapted for routing or switching data packets across said database area
3 network, said network device including network management means for managing routing or
4 switching functions of the network device and
5 said database switching module is adapted to use said network management means to
6 control the routing or switching functions of the network device.

1 23. The system of claim 22, wherein said network device is adapted to provide real time
2 routing of data packets across said database area network with low latency.

1 24. The system of claim 22, wherein said network device is adapted to provide real time
2 routing of data packets across said database area network with high bandwidth.

1 25. The system of claim 22, wherein said database switching module is adapted for
2 dynamically establishing said associations between database services and network addresses, and
3 for automatically communicating the establishment or modification to said associations to said
4 network device, whereby said database area network continues to function if said database
5 switching module stops operating.

1 26. The system of claim 25, wherein said database switching module stops operating because
2 of a failure of said database switching module or a connection between said database switching
3 module and said network device.

1 27. The system of claim 25, wherein said database switching module stops operating because
2 it is taken out of service for modification or upgrade.

1 28. The system of claim 14, wherein said database switching device is further adapted for
2 dynamically associating database services with network addresses as a function of predefined
3 resource management objectives.

1 29. The system of claim 28, wherein said resource management objectives are selected from
2 the group consisting of load balancing, quality of service, high availability and scalability.

1 30. The system of claim 28, wherein said database services are executed on a plurality of
2 database servers corresponding to said associated network addresses and said database switching
3 module further includes:

4 monitoring means for monitoring a plurality database servers for server status and server
5 resource usage;
6 mapping means for changing the associations between database services and network
7 addresses as a function said server status and said server resource usage.

1 31. The system of claim 30, wherein said mapping means is adapted for changing the
2 associations between database services and network addresses as a function of server resource
3 usage and said management resource objective of load balancing in order to balance the server
4 resource usage over a plurality of database servers.

1 32. The system of claim 30, wherein said mapping means is adapted for changing the
2 associations between database services and network addresses as a function of server resource
3 usage and said management resource objective of quality of service in order to make server
4 resources available to provide a predefined level of quality of service.

1 33. The system of claim 32, wherein said predefined level of quality of service is measured
2 as a function of allocated server resources.

1 34. The system of claim 32, wherein said predefined level of quality of service is measured
2 as function of a quantity of database server operations processed in a specified unit of time.

1 35. The system of claim 32, wherein said predefined level of quality of service is measured
2 as a function of a unit of time used to complete a database server operations or set of database
3 server operations.

1 36. The system of claim 30, wherein said mapping means is adapted for changing the
2 associations between database services and network addresses as a function of server resource
3 usage and said management resource objective of high availability in order to provide that a
4 database service is available from an alternative database server if said monitoring means detects
5 that a database server providing said database service experiences a failure.

1 37. The system of claim 30, wherein said mapping means is adapted for changing the
2 associations between database services and network addresses as a function of server resource
3 usage and said management resource objective of scalability in order to distribute database
4 resource usage over additional database resources added to the database area network.

1 38. The system of claim 1, wherein said database switching system includes a database area
2 network administration module adapted for controlling administrative access to devices and
3 services connected to the database area network.

1 39. The system of claim 38, wherein said database area network administration module
2 provides a plurality of levels of access including a first level which provides access to all devices
3 or services included in said database area network; and a second level of access which provides
4 access to specific databases and their associated instances.

1 40. The system of claim 38, wherein said database area network administration module is
2 adapted for controlling access by a first network device connected to said data area network to a
3 second network device connected to said data area network.

1 41. A method for operating a database area network (DAN) comprising the steps of:
2 connecting a plurality of database servers to a communication medium, each database
3 server including at least one database management system adapted for providing a plurality of
4 database services;
5 associating at least one database service with at least one database server; and
6 directing the transfer of database service requests to an associated database server as a
7 function of the association between at least one database service and at least one database server.

1 42. A method according to claim 41, wherein said step of directing the transfer of database
2 service requests includes routing or switching data packets containing the database service
3 requests between a database client and said database servers.

1 43. A method according to claim 41, wherein said step of directing the transfer of database
2 service requests includes translating a network destination address of a database service request
3 received from a database client to a network destination address of a database service.

1 44. A method according to claim 43, wherein said translated network destination address of a
2 database service is a network layer address or data link layer address.

1 45. A method according to claim 43, wherein said network destination address of a database
2 service is translated from a virtual network address to an actual network destination address.

1 46. A method according to claim 41, further including the step of relocating a database
2 instance from a first database server to a second database server.

1 47. A method according to claim 41, further including the steps of:
2 storing server resource information or database instance requirements in a data storage
3 device; and
4 said step of associating at least one database service with at least one database server
5 includes associating a database service with a database server as a function of the server resource
6 information or the database instance requirements stored in said data storage device

1 48. A method according to claim 41, further including the step of moving a database instance
2 from a first database server to a second database server as a function of a defined database
3 performance criteria.

1 49. A method according to claim 41, wherein the step of directing the transfer of database
2 service requests includes directing the transfer of database service requests to a database server
3 as a function of a portion of the content of a data packet containing said database service request.

1 50. A method according to claim 41 further comprising the step of transferring database
2 service requests in real time with low latency between the database servers and database clients.

1 51. A method according to claim 41 further comprising the step of transferring database
2 service requests in real time with high bandwidth between the database servers and database
3 clients.

1 52. A method according to claim 41 further comprising the step of:
2 connecting a database switch (dBSwitch) to said communications medium and wherein
3 said dBSwitch is adapted for associating at least one database service with at least one database
4 server and directing the transfer of database service requests to said database servers as a
5 function of the association between said database services and said at least one database server.

1 53. A method according to claim 52, wherein said dBSwitch includes a network device
2 adapted to provide data packet routing or switching functions to said communications medium,
3 and said routing or switching functions can be controlled using a command line interface
4 procedure or a network management protocol; and said method further includes the step of
5 controlling the routing or switching function of the routing or switching device using a command
6 line interface procedure or a network management protocol.

1 54. A method according to claim 53, further comprising the step of modifying the switching
2 or routing function of said switching or routing device as a function of said associations between
3 the database services and said at least one database server.

1 55. A method according to claim 52, wherein said dBSSwitch includes a database switching
2 module and method includes the steps of:

3 said database switching module dynamically establishing associations between database
4 services and database servers;

5 automatically communicating the establishment or modification to said associations to
6 said network device, and,

7 continuing to transfer said database service requests to an associated database server even
8 if said database switching module stops operating.

1 56. A method according to claim 55, wherein said database switching module stopped
2 operating because of a failure in said database switching module.

1 57. A method according to claim 55, wherein said database switching module stopped
2 operating because it was taken out of service for modification or upgrade.

1 58. A method according to claim 55, further comprising the step of said database switching
2 module dynamically associating database services with network addresses as a function of
3 predefined resource management objectives.

1 59. A method according to claim 58, wherein said resource management objectives are
2 selected from the group consisting of load balancing, quality of service, high availability and
3 scalability.

1 60. A method according to claim 58, wherein said database services are executed on a
2 plurality of database servers corresponding to said associated network addresses and said method
3 further includes the steps of

4 said database switching module monitoring a plurality of database servers for server
5 status and resource usage; and

6 said database switching module changing the associations between database services and
7 network addresses as a function of said server resource usage.

1 61. A method according to claim 60, wherein the step of changing the associations between
2 database services and network addresses includes changing the associations between database
3 services and network addresses as a function of server resource usage and said management
4 resource objective of load balancing in order to balance the server resource usage over a plurality
5 of database servers.

1 62. A method according to claim 60, wherein said step of changing the associations between
2 database services and network addresses includes changing the associations between database
3 services and network addresses as a function of server resource usage and said management
4 resource objective of quality of service in order to make server resources available to provide a
5 predefined level of quality of service.

1 63. A method according to claim 62, wherein said predefined level of quality of service is
2 measured as a function of allocated server resources.

1 64. A method according to claim 62, wherein said predefined level of quality of service is
2 measured as function of a quantity of database server operations processed in a specified unit of
3 time.

1 65. A method according to claim 62, wherein said predefined level of quality of service is
2 measured as a function of a unit of time used to complete a database server transaction or set of
3 database server transactions.

1 66. A method according to claim 60, wherein said step of changing the associations between
2 database services and network addresses includes changing the associations between database
3 services and network addresses as a function of server resource usage and said management
4 resource objective of high availability in order to provide that a database service is available
5 from an alternative database server if said monitoring means detects that a database server
6 providing said database service experiences a failure.

1 67. A method according to claim 60, wherein said step of changing the associations between
2 database services and network addresses includes changing the associations between database
3 services and network addresses as a function of server resource usage and said management
4 resource objective of scalability in order to distribute database resource usage over additional
5 database resources added to the database area network.

1 68. A method according to claim 41, wherein said database switching module includes a
2 database area network administration module and said method includes the steps of said database
3 area network administration module providing administrative access control to devices and
4 services connected to the database area network.

1 69. A method according to claim 68, further comprising the step of:
2 said database area network administration module providing a plurality of levels of
3 access including a first level which provides access to all devices or services included in
4 connected to said database area network; and a second level of access which provides access to
5 specific databases and their associated instances.

1 70. A method according to claim 68, further comprising the step of said database area
2 network administration module controlling access by a first network device connected to said
3 data area network to a second network device connected to said data area network.

1 71. An apparatus adapted for transferring data packets between at least one database server
2 and at least one database user, said apparatus comprising:
3 connecting means for connecting at least one database client and at least one database
4 server; and
5 switching means for directing the transfer of said data packets between a database user
6 and at least one database server.

1 72. An apparatus according to claim 71 wherein said switching means includes a switching
2 or routing device adapted for routing said data packets between said database client and at least
3 one of said database management systems.

1 73. An apparatus according to claim 70 wherein
2 said directing means includes translation means for translating a network destination
3 address of a database service request received from a database client to a network destination
4 address of a database server.

1 74. An apparatus according to claim 73 wherein said translated network destination address
2 of a database service is a network layer addresses or data link layer addresses.

1 75. An apparatus according to claim 73 wherein said network destination address of a
2 database service is translated from a virtual network address to an actual network destination
3 address.

1 76. An apparatus according to claim 71 further comprising a routing or switching device
2 adapted to provide data packet routing or switching functions and said routing or switching
3 functions can be controlled using a command line interface procedure or a network management
4 protocol.

1 77. An apparatus according to claim 71 further comprising a redirection module adapted for
2 relocating a database instance from a first database server to a second database server.

1 78. An apparatus according to claim 71 further comprising a resource management module
2 adapted for managing database instance assignments to database servers.

1 79. An apparatus according to claim 78 wherein said resource management module further
2 includes a data storage device and is adapted for storing server resource information or database
3 instance requirements in said data storage device.

1 80. An apparatus according to claim 79 wherein said resource management module is further
2 adapted for managing database instance assignments as a function of the server resource
3 information or the database instance requirements.

1 81. An apparatus according to claim 79 wherein said resource management module is
2 adapted for storing constraints or preferences regarding database instance redirection in said data
3 storage device.

1 82. An apparatus according to claim 81 wherein said resource management module is further
2 adapted for managing the association between database instances and database servers as a
3 function of said constraints or preferences regarding database instance redirection stored in said
4 data storage device.

1 83. An apparatus according to claim 71 further comprising a module adapted for moving a
2 database instance from a first database server to a second database server as a function of a
3 defined database performance criteria.

1 84. An apparatus according to claim 71 further comprising a database switching module
2 adapted for associating database services with network addresses.

1 85. An apparatus according to claim 84 wherein said network address are virtual network
2 addresses.

1 86. An apparatus according to claim 84 wherein said network address are network layer
2 addresses or data link layer addresses.

1 87. An apparatus according to claim 84 wherein said switching means is adapted for
2 directing the transfer of data packets between said database clients and said database servers as a
3 function said associations between said database services and said network addresses.

1 88. An apparatus according to claim 84 wherein said switching means is adapted for
2 directing the transfer of data packets between said database clients and said database
3 management systems by replacing a network address of said data packet containing a database
4 service request with the network address associated with that service.

1 89. An apparatus according to claim 88 wherein the network address of said data packet
2 containing a service request is a virtual network address and said virtual network address is
3 replaced with a real network address associated with said service.

1 90. An apparatus according to claim 88 wherein the network address of said data packet
2 containing a service request is for a network address on a first subnetwork and said network
3 address is replaced with a network address associated with said database service on a second
4 subnetwork.

1 91. An apparatus according to claim 84 wherein said database switching system includes a
2 content switch adapted to read at least a portion of the contents of packets transferred between
3 said at least one database client and said database management systems.

1 92. An apparatus according to claim 84 further comprising
2 a network device adapted for routing or switching data packets across said database area
3 network, said network device including network management means for managing routing or
4 switching functions of the network device and
5 said database switching module is adapted to use said network management means to
6 control the routing or switching functions of the network device..

1 93. An apparatus according to claim 92 wherein said network device provides real time
2 routing of data packets across said database area network with low latency.

1 94. An apparatus according to claim 92 wherein said network device provides real time
2 routing of data packets across said database area network with high bandwidth.

1 95. An apparatus according to claim 92 wherein said database switching module is adapted
2 for dynamically establishing said associations between database services and network addresses,
3 and for automatically communicating the establishment or modification to said associations to
4 said network device, whereby said database area network continues to function if said database
5 switching module stops operating.

1 96. An apparatus according to claim 95 wherein said database switching module stops
2 operating because of a failure of said database switching module or a connecting between said
3 database switching module and said network device.

1 97. An apparatus according to claim 95 wherein said database switching module stops
2 operating because it is taken out of service for modification or upgrade.

1 98. An apparatus according to claim 84 wherein said database switching device is further
2 adapted for dynamically associating database services with network addresses as a function of
3 predefined resource management objectives.

1 99. An apparatus according to claim 98 wherein said resource management objectives are
2 selected from the group consisting of load balancing, quality of service, high availability and
3 scalability.

1 100. An apparatus according to claim 98 wherein said database services are executed on a
2 plurality of database servers corresponding to said associated network addresses and said
3 database switching module further includes:
4 monitoring means for monitoring a plurality database servers for server status and server
5 resource usage;
6 mapping means for changing the associations between database services and network
7 addresses as a function said server status and server resource usage.

1 101. An apparatus according to claim 100 wherein said mapping means is adapted for
2 changing the associations between database services and network addresses as a function of
3 server resource usage and said management resource objective of load balancing in order to
4 balance the server resource usage over a plurality of database servers.

1 102. An apparatus according to claim 100 wherein said mapping means is adapted for
2 changing the associations between database services and network addresses as a function of
3 server resource usage and said management resource objective of quality of service in order to
4 make server resources available to provide a predefined level of quality of service.

1 103. An apparatus according to claim 102 wherein said predefined level of quality of service is
2 measured as a function of allocated of server resources.

1 104. An apparatus according to claim 102 wherein said predefined level of quality of service is
2 measured as function of a quantity of database server operations processed in a specified unit of
3 time.

1 105. An apparatus according to claim 102 wherein said predefined level of quality of service is
2 measured as a function of a unit of time used to complete a database server operation or set of
3 database server operations.

1 106. An apparatus according to claim 100 wherein said mapping means is adapted for
2 changing the associations between database services and network addresses as a function of
3 server resource usage and said management resource objective of high availability in order to
4 provide that a database service is available from an alternative database server if said monitoring
5 means detects that a database server providing said database service experiences a failure.

1 107. An apparatus according to claim 100 wherein said mapping means is adapted for
2 changing the associations between database services and network addresses as a function of
3 server resource usage and said management resource objective of scalability in order to distribute
4 database resource usage over additional database resources added to the database area network.

1 108. An apparatus according to claim 71 wherein said database switching system includes a
2 database area network administration module adapted for controlling administrative access to
3 devices and services connected to the database area network.

1 109. An apparatus according to claim 108 wherein said database area network administration
2 module provides a plurality of levels of access including a first level which provides access to all
3 devices connected to said database area network; and a second level of access which provides
4 access to specific databases and associated instances of said specific databases.

1 110. An apparatus according to claim 108 wherein said database area network administration
2 module is adapted to control said database switching system to control database area network
3 access to network devices or databases.

1 111. An apparatus according to claim 71 wherein said connecting means allows for connection
2 of the apparatus between two data link layer switches, where one data link layer switch is
3 connected to at least one database server, and the other data link layer switch is connected to at
4 least one database client

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112. An apparatus according to claim 71 wherein said connecting means allows for connection
1 of the apparatus to a data link layer switch, where the data link layer switch is connected to at
2 least one database server and at least one database client
3